PHENIX

PHENIX RPC GAS SYSTEM OPS in the RPC Factory

procedure name

PHENIX Procedure No. PP-2.5.2.15-1

Revision: C **Date: 1/28/2013**

Hand Processed Changes

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Approvals

1/24/13
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REVISION CONTROL SHEET

LETTER	DESCRIPTION	DATE	AUTHOR	APPROVED BY	CURRENT OVERSIGHT
A	First Issue (Note: Title changed 1/29/08 by D.Lynch after signoff to avoid confusion with HV procedure. No changes to actual procedure.	10/27/2007	D. Northacker	D. Lynch, D. Northacker, R. Pisani, A. Etkin	R. Pisani
B	Section 4.0 last sentence "PHENIX controlled document PP-2.5.5.6-10" was "the RPC factory handbook". Section 8 in Flow to chambers 2nd paragraph added "These lines are to be capped when not in use." Same section step 8 added ", cap lines"	1/10/2010	Changes by D. Lynch	D.Lynch, R. Pisani, P. Giannotti	R. Pisani
C	RPC Factory operations have been completed, therefore this procedure is currently inactive.	1/28/2013	D. Lynch	D.Lynch, R. Pisani, P. Giannotti	R. Pisani

Introduction:

This system is designed to provide mixed gas for up to 20 RPC chambers located in the RPC factory area inside Building 912. There are two separate HV tests required during production; one for incoming components, and one for finished detectors. A mixture containing 95% Freon 134a, 4.5% isobutane, and 0.5% sulfur hexafluoride is used for both tests. All exhaust from the tests is gathered in a common line and vented outside of the building.

The present system will provide a maximum of about 250 ccm total flow that would be distributed between all the chambers. Each chamber will receive 10 - 20 ccm of mixed gas, and will be operated at a pressure less than 10 inches of water. The first test (dark current) required involves running 10 chambers for about 3 days, and the second test (cosmic ray) requires running 10 chambers for about 2-3 weeks - under continuous HV. The cylinders connected to the system are located inside Building 912, but outside the tent area. The regulation/shutoff rack and the mixing rack are also outside the tent, against an adjacent shielding block. There will be gas leak detectors installed in the vicinity of the rack that are sensitive to all three gases used, and if activated will shut off all three components. The solenoid valves used for this purpose will also shut off flow in the event of a fire alarm or power outage within the building.

1.0 Purpose and Scope

The goal of this procedure is to instruct **authorized** RPC factory personnel in the correct procedure for starting the RPC factory gas system and for purging the RPC chambers with dry Nitrogen prior to the introduction of a mixture with a flammable component.

This procedure contains the steps necessary to start the RPC factory gas system from a fully shutdown state and to purge the RPC detectors with Nitrogen. In this operation, Nitrogen gas is routed from a tank that resides outside of Building 912 through all portions of the RPC Facory gas system and then into the RPC chambers. The gas from the chambers is vented to the Vent line outside Building 912. The gas flow will be about 0.250 liter per minute (LPM).

At the end of this procedure the RPC chambers can be maintained in a standby state with a low flow of Nitrogen or the operator can continue on and run with R134A+4.5% isobutane/ 0.5% SF6 Mixture.

In addition to the Operating Procedures this document specifies the Local Emergency Plan of the RCP Factory. This Local Emergency Plan will ensure:

1.1 The safety of all personnel from risks associated with the operation of the RPC Factory gas system

1.2 The implementation of the appropriate emergency procedures

1.3 Prompt notification of the appropriate C-A and S&EP specialists

1.4 The maintenance of appropriate C-A emergency status

1.5 The preservation and protection of the environment

1.6 The preservation of BNL facilities and equipment

2.0 Responsibilities –

During RPC Factory operations, there will be two levels of responsibility for the oversight of the RCP Factory gas systems: the RPC Factory crew and the RPC Factory Authorized GAS experts.

The first level of responsibility resides with the RPC Factory crew. During any period when the RPC chambers have a flammable component or SF6 gas flowing, the crew will be responsible for monitoring the status of the RPC factory gas system. Checklist shall be filled out periodically. The nature of the checklist and time intervals shall be specified in the RPC factory hand book. The second level of responsibility resides with the RPC Factory Authorized GAS experts. The gas experts will be on-call 24/7 to respond to any alarm or unusual occurrence detected by the RPC Factory crew. A record of the performance of the RPC Factory gas system will be maintained and monitored by the RPC Factory Authorized gas system experts and factory crew.

During watch shifts or data taking, it will be the responsibility of the RPC Factory Crew to:

2.1 Monitor the status and alarms for the gas system.

2.2 **In the event of an alarm or unusual occurrence, contact an on-call RPC Factory Authorized GAS expert.**

The second level of responsibility is the gas experts. It is the responsibility of the Gas experts to:

2.3 Maintain the RPC Factory Gas System in a safe operating condition. This includes:

2.3.1 Changing gas cylinders and dewars when required

2.3.2 Setting, adjusting, and checking the gas mixture, flow rates and pressures.

2.3.3 Checking the certification of the operating gas

2.3.4 Posting any special instructions or notifications as required

2.3.5 Carrying out any emergency actions, as prescribed in the Procedures section of this document.

3.0 Prerequisites

The RPC Factory Authorized gas Expert shall have read or have training in the following areas:

3.1 PHENIX RPC Factory Training,

3.2 BNL Compressed Gas Safety Training Course,

3.3 BNL Electrical Safety I

3.4 CA User and PHENIX Awareness

3.5 BNL Haz-com

3.6 BNL General Employee Training

4.0 Precautions

The safety of personnel is of primary importance. The RPC Factory Gas experts shall take great care to ensure that the RCP Factory Gas Systems will be operated in a way that does not place personnel or equipment at risk of physical harm. The RPC Factory gas system shall not be operated without the SF6 monitoring system and fire detection system being on. Information on these system can be found in PHENIX controlled document PP-2.5.5.6-10.

5.0 Start up Procedure

(Use Figures 1, 2 & 3 for reference)

Turning on the system:

1. Make sure all manual valves on the bottle regulator, and both the regulator/shutoff rack and the mixing rack are closed (MV 1,2,3,4-F; MV 1,2,3,4-I; MV 1,2,3,4-S).

2. Connect bottle regulators to cylinders (Freon 134a uses CGA 660, isobutane uses CGA 510, and SF6 uses CGA 590), open cylinder valves slowly, and check for leaks at the bottle fitting using either a portable leak detector or soap solution.

3. Adjust bottle regulators to 25-30 psi output pressure, and open regulator output valves (MV 1-F, MV 1-I, MV 1-S) so that the flow reaches the regulation rack. Open and close MV 2-F, MV 2-I, MV 2-S one at a time for a few seconds to allow each line to purge

into a common vent line.

4. Open MV 3-F, MV 3-I, and MV 3-S one at a time to allow pressure to reach the regulators (PCV 2-F, PCV 2-I, and PCV 2-S), and adjust output pressures to 20 psi on PG 3-F, PG 3-I, and PG 3-S.

5. Check the shutoff alarm status on the switching panel (just above the regulators) by looking at the indicator lights. If the three white indicator lights are on, the solenoids are powered and open. If these lights are off, and the red light on SW 2 is lit, an alarm has turned off the solenoid valves. Pressing the switch will acknowledge the alarm, and reset the solenoids – if the sensors are no longer in alarm. Normally, the solenoids are turned on and off using SW 1.

Turning on the mixer:

Although it is likely that the system will be in constant use much of the time, there will be an occasional need to turn it off and on. When turning the system on, there is always some period of time when the mixture is unstable. Until the mixer reaches a steady state condition (perhaps one or two hours), the mixture should be vented outside.

1. On one of the two distribution racks inside the tent – preferably the one that will be needed - open MV1-CR (or MV1-DC).

2. At this time, ensure that the vent flowmeter (FM1-CR or FM1-DC) is open and will not restrict the flow. This will allow the mixer output to be vented into an exhaust line, as well as allowing the supply line to the distribution rack to be purged with fresh gas once the mixer is turned on.

3. Open the three input valves (MV 4-F, MV 4-I, MV 4-S) located at the base of the mixing rack.

4. The input pressure gauges (PG 4-F, PG 4-I, PG 4-S) should all read 20 psi.

5. Turn on mixer using switch on back of control box mounted on top of the mixing rack. This allows flow through the mass flow controllers (MFC 1-F, MFC 1-I, MFC 1-S), and the electronic display on the control box should read the measured flow going through each controller. This flow is visually indicated with the flow indicators (FI 1-F, FI 1-I, FI 1-S) that are immediately downstream of each mass flow controller.

6. The combined flow can now be visually observed with the mixer output flowmeter (FM 1-M).

7. This flowmeter should be adjusted to allow all the mixed gas through without building up pressure within the mixer, as observed on the mixing pressure gauge (PG 1-M).

Flow to chambers:

There are two identical distribution racks that allow flow to the chambers being tested. An input valve (MV 2-CR or MV 2-DC) allows for the selection of either nitrogen or mixed gas for a group of up to 10 chambers. The entire flow to the rack is adjusted with the input flowmeter (FM 2-CR or FM 2-DC). Both racks contain 10 output flowmeters, each with a maximum capacity of 50 ccm. They are both located inside the tent, next to the test stands – one for cosmic ray (CR), and one for dark current (DC) tests.

There are two lines used for each chamber: one input, and one exhaust. **These lines are to be capped when not in use**. The input lines connect the panel flowmeters (FM 3-CR through FM 12-CR, or FM 3-DC through FM 12-DC) to the chambers, and the exhaust lines are connected to the exhaust bubblers (BU 1-CR through BU 10-CR, or BU 1-DC through BU 10-DC).

Test procedure:

1. Ensure normal flow through the distribution rack by turning MV 2-CR (or MV 2-DC) to the "nitrogen" position, and observe the flow in the distribution flowmeters (FM 3-CR through FM 12-CR; or FM 3-DC through FM 12-DC). The flow through each flowmeter should be between 30 and 50 CCM - before any lines are connected to the chambers.

2. Make sure the flow is consistent through all the flowmeters, and adjust if necessary.

3. After verifying flow, turn MV 2-CR (or MV 2-DC) to the "off" position, and connect the appropriate input/exhaust lines to the chambers being tested.

4. Turn MV 2-CR (or MV 2-DC) to the "nitrogen" position, and verify flow through all chambers by observing the bubble rate for each chamber.

5. If the mixer has just been turned on, allow it to stabilize during the time the chambers are are being connected and purged with nitrogen.

6. Allow chambers to purge with nitrogen for about an hour, and then switch MV 2-CR (or MV 2-DC) over to "mixed gas". At this point the chambers should be purged for 5-10 volume changes before applying HV.

7. Once the tests are complete, the chambers should be purged with nitrogen again, by turning MV 2-CR (or MV 2-DC) to the "nitrogen" position and allowing flow through the chambers for an hour or two.

8. Turn off flow at MV 2-CR (or MV 2-DC), and disconnect all lines to chambers, cap lines.

9. If the mixer is no longer needed, close MV 4-F, MV 4-I, and MV 4-S, and turn off mixer. This should be done shortly after chambers are switched over to nitrogen.

10. Close off all three cylinder valves for the Freon 134A, the isobutane, and the sulfur hexafluoride.

11. Release the high pressure side of the bottle regulators by momentarily opening the line purge valves (MV 2-F, MV 2-I, MV 2-S), but allow some line pressure to remain in the rest of the system.

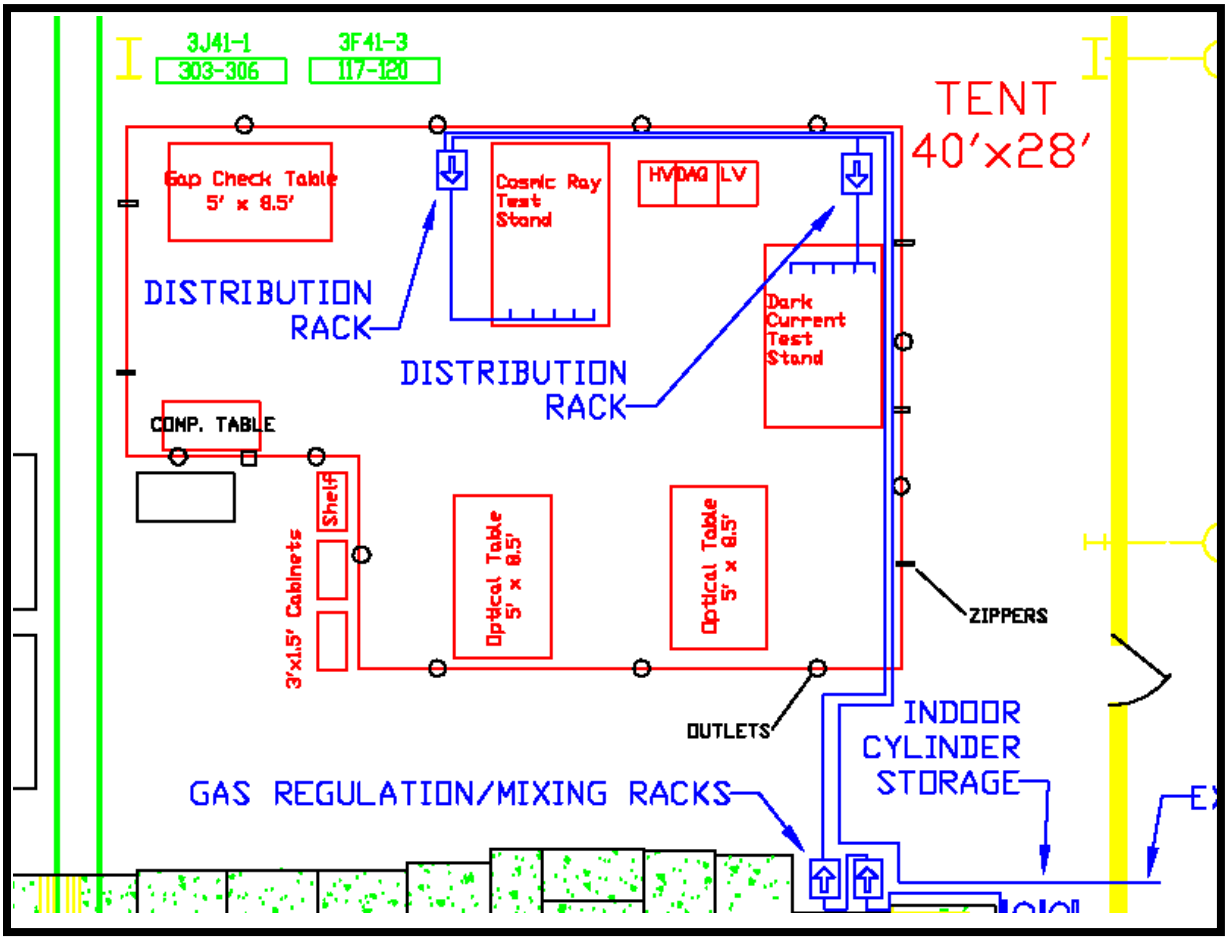

Figure 1: Factory Gas Line Layout

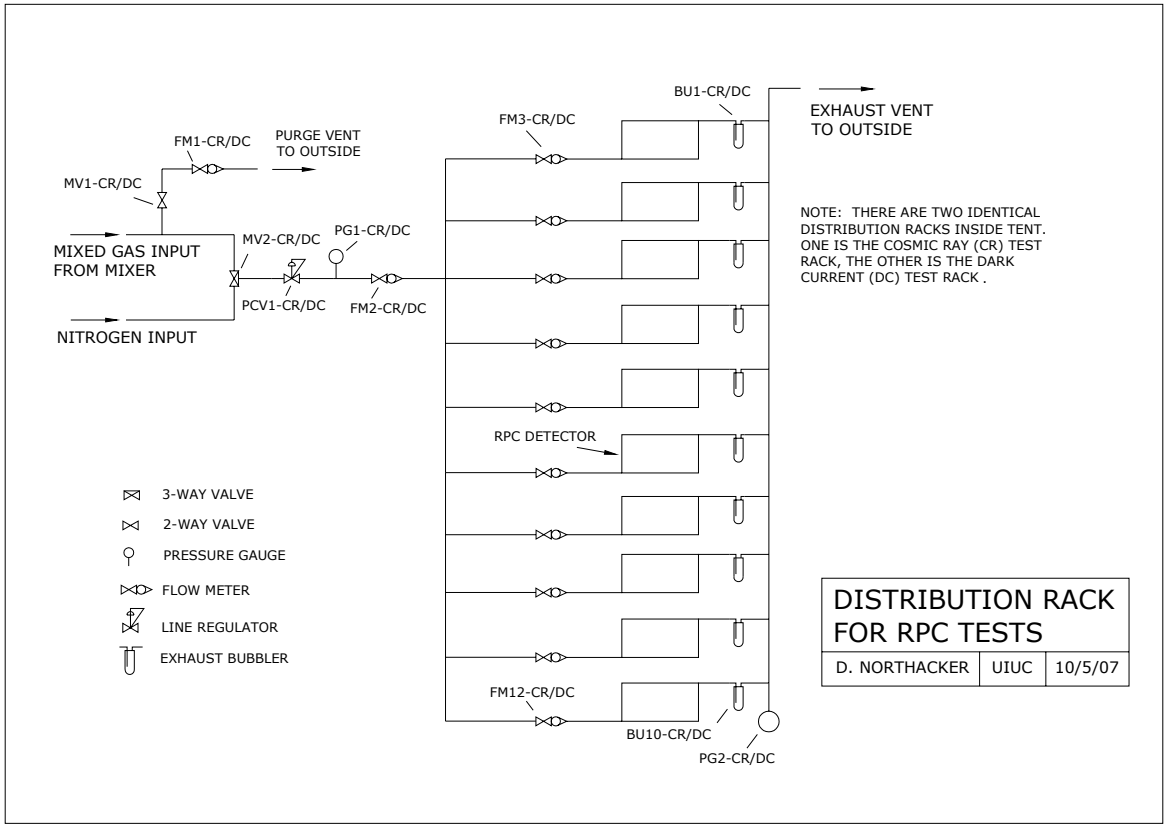

Figure 2: Distribution Rack for RPC Factory Gas System

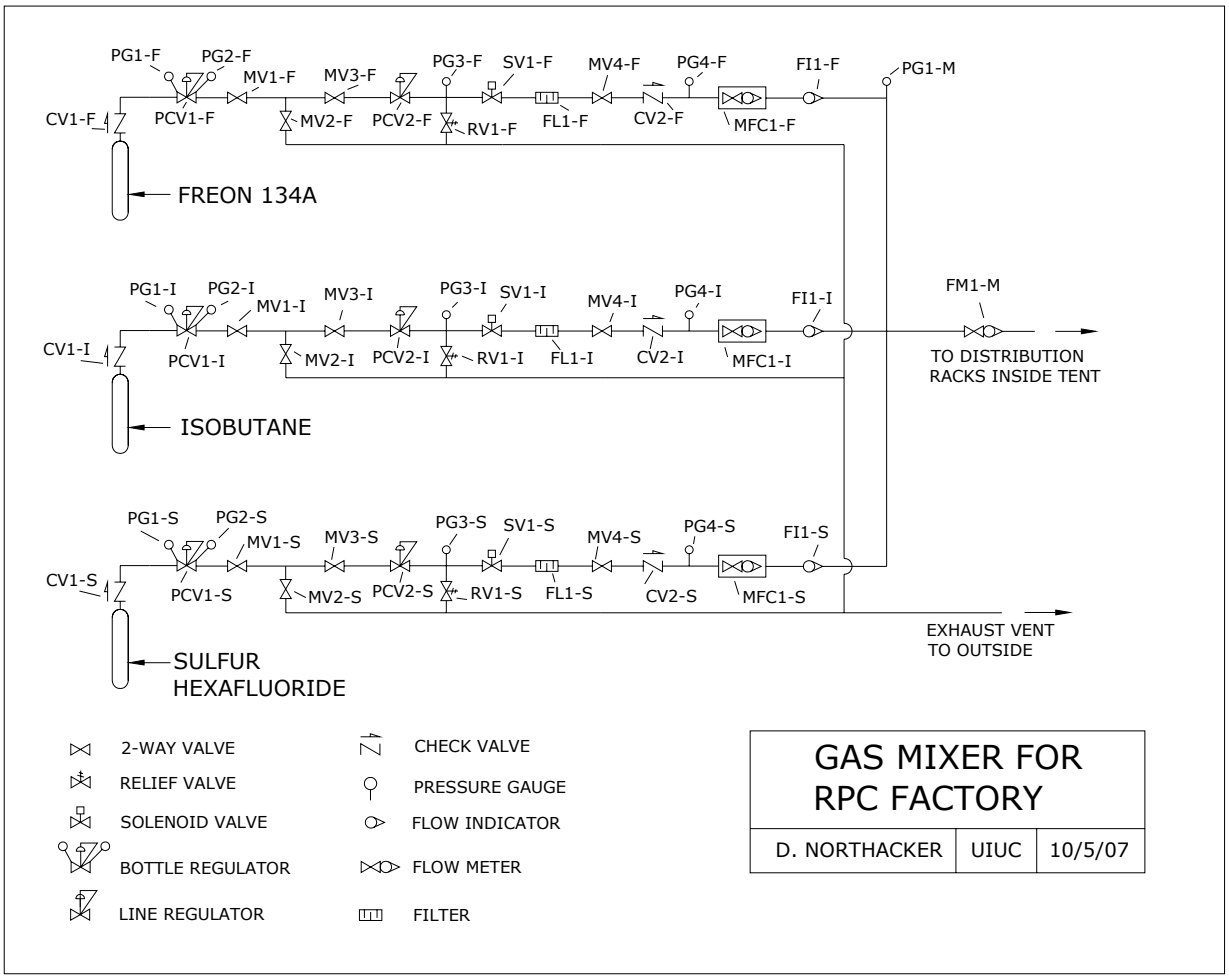

Figure 3: Gas Mixer for RPC Factory